

# OCEANOGRAPHY



**REGIONAL SCIENCE OLYMPIAD**  
**FEBRUARY 3, 2007**

**TEAM NAME** \_\_\_\_\_  
**TEAM NUMBER** \_\_\_\_\_

1. The rule of constant proportions
  - a. allows oceanographers to determine salinity from the concentration of a single, major ion in saltwater.
  - b. means that net evaporation is constant at all distances on either side of the equator.
  - c. means that the temperature in the Arctic ocean is constant below the "density floor"
  - d. Says the annual average of infrared radiation in the atmosphere remains constant.
  
2. Desert-like conditions (low biological productivity) exists in the surface waters of the ocean in the
  - a. Southern ocean
  - b. Arctic Ocean
  - c. subtropical gyres
  - d. Continental shelves
  
3. The phenomenon known as coral bleaching occurs when
  - a. Chlorine ions increase in the vicinity of living corals
  - b. Stressed corals expel their zooxanthellae
  - c. Low tides expose corals to the sun
  - d. Coral colors fail to develop normal intensity due to nutrient deficiency.
  
4. High frequencies tell krill their relative position from their neighbors because the frequency strength:
  - a. increases over time
  - b. Stays the same over distance
  - c. Decreases rapidly over distance
  - d. Cannot be heard by all species of krill
  
5. Many fish and invertebrates living in the lower euphotic or aphotic zone are red in color because:
  - a. Red is highly visible and is used to attract mates.
  - b. Red indicates toxic or venomous organisms and swerves as a warning.
  - c. Most predators are colorblind.
  - d. Red objects are practically invisible at these depths.
  
6. Annually, the largest total oceanic primary production occurs in which oceanographic region of the ocean?
  - a. temperate zones
  - b. tropics
  - c. sub-tropics
  - d. Western boundary currents

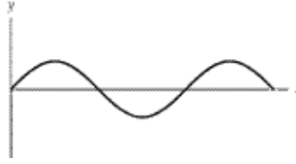
7. Calm water is more likely to have
  - a. More turbidity
  - b. More matter in the water column
  - c. Less dissolved gases
  - d. More dissolved gases
  
8. About what percentage of the seafloor is covered by exclusive economic zones?
  - a. 16
  - b. 24
  - c. 36
  - d. 52
  
9. A Cromwell current is found in the
  - a. Antarctic Ocean
  - b. Indian Ocean
  - c. Arctic Ocean
  - d. Pacific Ocean
  
10. The waters in areas with limestone bedrock are usually not heavily acidified by acid rain because the acid rain in these areas is neutralized by the
  - a. buffering action of the rocks
  - b. porous nature of the rocks
  - c. smoothness of the rocks
  - d. none of the above
  
11. Which of the following estuaries is thought to be the most modified estuary in the U.S.
  - a. Columbia River
  - b. San Francisco Bay
  - c. Chesapeake Bay
  - d. Mississippi River
  
12. A river which doesn't have a major marine delta associated with it is the
  - a. Mississippi
  - b. Columbia
  - c. Nile
  - d. Amazon
  
13. A standing wave in an enclosed water basin is a
  - a. cosine
  - b. seiche
  - c. splash
  - d. tangent

14. Thick unconsolidated sediments are usually encountered
  - a. in the rift valley of the mid-ocean mountains.
  - b. on the continental rise
  - c. in the deep marginal trenches
  - d. on the tops of guyots (ghee-ohs)
  
15. Compared to the speed of sound in air, the speed of sound in seawater is:
  - a. faster by about a factor of two
  - b. faster by about a factor of five
  - c. slower by about a factor of two
  - d. slower b about a factor of three
  
16. The waves with a 10 second wave period will have a wavelength of approximately
  - a. 50 m
  - b. 100 m
  - c. 150 m
  - d. 200 m
  
17. The most important cause of recent eustatic sea level change is the
  - a. formation and destruction of lakes
  - b. changes in the rates of sea-floor spreading
  - c. Melting of glaciers
  - d. movements of continents
  
18. The method of analyzing tides which takes into account the presence of the continents and their effect on tides is ...
  - a. harmonic analysis
  - b. equilibrium
  - c. dynamic tidal analysis
  - d. static tidal analysis
  
19. How is a new type of sonar that uses background noise to detect objects different than active sonar?
  - a. It cannot be used by dolphins
  - b. It doesn't send out a signal to be returned
  - c. It requires a vacuum
  - d. It sends wave like signals
  
20. Groins are structures built mainly to
  - a. prevent local beach erosion
  - b. serve as fishing locations
  - c. mark property boundaries
  - d. serve as boat docks

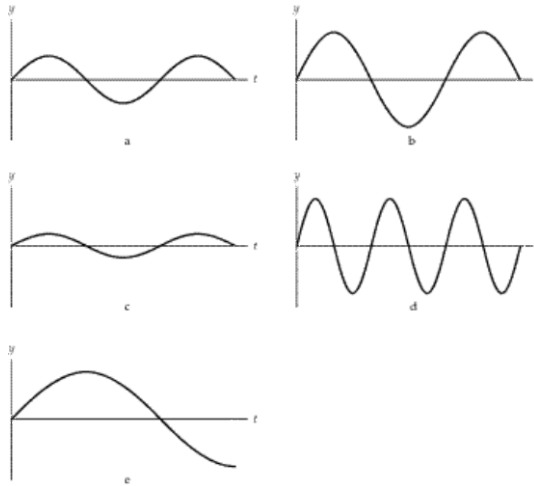
21. Temperature and salinity will both affect:
- the depth to which light penetrates the ocean
  - the speed of ocean surface currents
  - the speed of sound in seawater
  - the shape of the local halocline
22. Which of the following best describes the impact of freshwater flow into an estuary?
- the speed of flood tidal currents increases
  - Ebb tide is prolonged
  - Flood tide is prolonged
  - The tidal range is increased.
23. The El Nino phenomenon is not normally associated with:
- increased hurricane activity in the Caribbean
  - Heavy rain and flooding in California
  - Drought in Indonesia
  - Colder winters in the Northern U.S.
24. Why is the Gulf Stream stronger than the California current?
- Eastern intensification
  - Constant coriolis effect
  - Beta effect
  - Eastern intensification and the beta effect.
25. The production of andesitic lava is a result of the melting of
- A combination of oceanic and continental material
  - Mantle material
  - Ophiolitic material
  - Subducted continental material.
26. A wave will break against the shore when:
- The force of the wind tips the wave over
  - The height of the wave above the water is equal to the depth of the water under the wave.
  - Surfers are waiting for a good one.
  - The sine wave is unequal

## OCEAN WAVE PROBLEMS

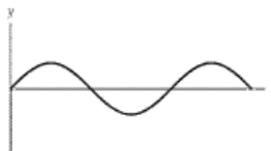
27. The figure below shows a sine wave as a function of time.



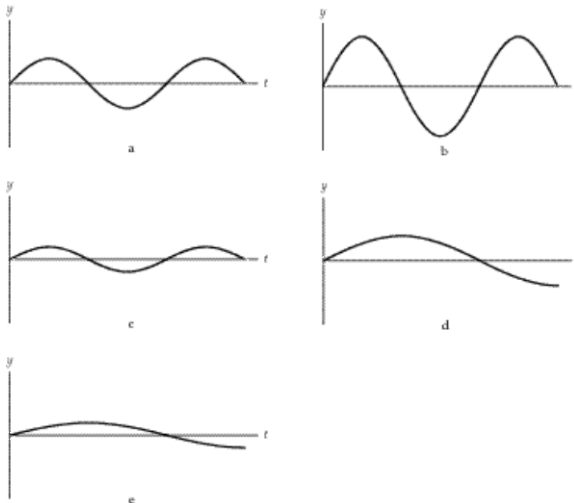
Which of the graphs below shows a wave where the amplitude and the frequency are doubled?



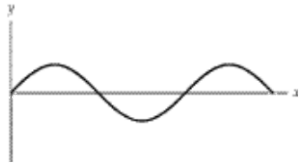
28. The figure below shows a sine wave as a function of time.



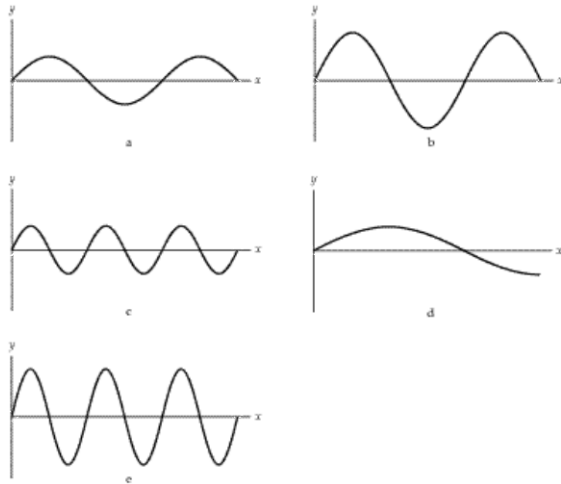
Which of the graphs below shows a wave where the wavelength and frequency are each reduced by half?



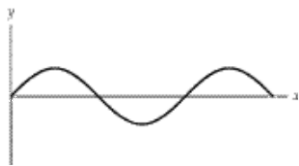
29. The figure below shows a sine wave at one instant of time.



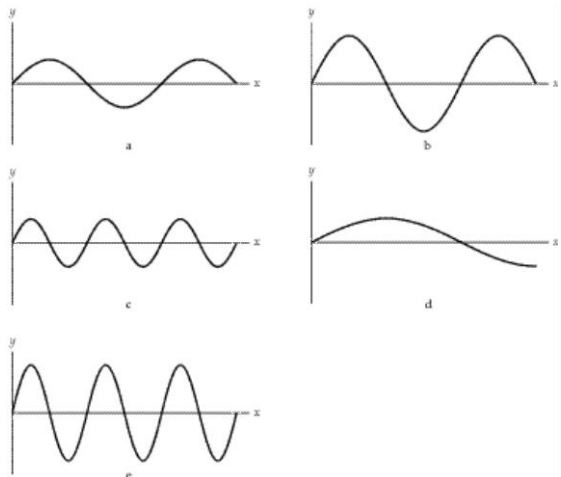
Which of the graphs below shows a wave where the frequency and wave velocity are both doubled?



30. The figure below shows a sine wave on a string at one instant of time.



Which of the graphs below shows a wave where the wavelength and frequency are each reduced by half?



## Laboratory Portion

Materials: Straws, gum, sand, beakers, markers, 5 solutions with different salinities, small test-tubes, test tube rack, pipettes, distilled water.

Determine the relative salinity of these 5 solutions using the materials provided. Write your procedure and data up as a science experiment. Include the following:

1. Brief introduction (Problem and hypothesis)
2. Methods
3. Results and Analysis
4. Discussion and Conclusion

(Keep the report to this page only - front and back if needed)

## Answers

1. A
2. C
3. B
4. C
5. D
6. A
7. C
8. C
9. C
10. A
11. B
12. B
13. B
14. B
15. B
16. C
17. C
18. C
19. B
20. A
21. C
22. B
23. A
24. C
25. A